EMERGENCY AIRWORTHINESS DIRECTIVE

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U.S. Department
of Transportation
Federal Aviation Administration

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DATE: July 25, 2000
2000-15-52

Send to all U.S. owners and operators of Bell Helicopter Textron, Inc. (BHTI) Model 204B, 205A, 205A-1, 205B, and 212 helicopters.

This superseding Emergency Airworthiness Directive (AD) is prompted by an occurrence of a cracked main rotor mast (mast) at a lower value than the established Retirement Index Number (RIN) life limit. This action is necessary to preclude the occurrence of fatigue cracks in the damper clamp splined area of a mast. A crack in the damper clamp splined area could result in failure of a mast or main rotor trunnion (trunnion), separation of the main rotor system, and subsequent loss of control of the helicopter.

On November 13, 1998, the FAA issued AD 98-24-15. That AD required establishing a RIN tracking system for mast and trunnion torque events; creating component history cards or equivalent records; converting accumulated factored flight hours to a baseline accumulated RIN count; establishing a system for tracking increases to the accumulated RIN; and establishing a maximum accumulated RIN for certain masts and trunnions. That action was prompted by an accident involving a BHTI Model 205A-1 helicopter in which a mast failure caused a separation of the main rotor from the helicopter. A subsequent metallurgical examination revealed that the mast had fractured as a result of fatigue. Analyses and fatigue testing conducted by the manufacturer confirmed that the remaining lives of the mast and trunnion are more accurately assessed by monitoring the number of torque events and flight hours on the helicopter rather than by monitoring only flight hours.

The FAA superseded AD 98-24-15 by issuing Emergency AD 2000-08-52 on April 21, 2000. AD 2000-08-52 required a one-time special inspection for certain serial numbered (S/N) masts to detect burrs or inadequate radii in the snap ring groove areas that can cause fatigue failure. That AD was issued as a result of an accident involving a BHTI Model 212 helicopter following in-flight separation of its main rotor system. The post-accident investigation revealed a fatigue failure in the damper clamp splined area of the mast, P/N 204-011-450-007. Also, operators reported at least five other failures in the damper clamp splined area of masts, P/N 204-011-450-001, -007, and -105, in either the upper or lower snap ring grooves. That AD also reduced the maximum allowable RIN life for each affected mast and changed the RIN counting procedure to require application of a standard RIN factor for all external load lifts regardless of altitude change and the type of load lifted. The RIN factor assessed for each torque event was increased for masts installed on BHTI Model 204B and 205B helicopters. The requirements of AD 98-24-15 pertaining to trunnions, P/N 204-011-105-001 and -103, were not changed by AD 2000-08-52.

Since the issuance of AD 2000-08-52, the FAA has received a report of another cracked mast. Metallurgical inspection revealed that the mast cracked as a result of fatigue in snap ring groove radii that were smaller than the 0.020 inch minimum allowable dimension. Detailed takeoff (1,249) and lift (16,339) event data for the entire life of the mast confirm that the accumulated RIN count at the time the fatigue crack was detected was approximately 68,000 when calculated in accordance with the most recent RIN counting procedure as defined in AD 2000-08-52. The FAA has concluded that several corrections to the RIN counting procedure are required based on a review of the fatigue data and previously issued AD's.

This AD is being issued to correct an unsafe condition that is likely to exist or develop on other BHTI Model 204B, 205A, 205A-1, 205B, and 212 helicopters of these same type designs. This AD retains the following requirements of AD 2000-08-52:

- Reduces the allowable RIN life limit established in AD 98-24-15 for masts, P/N 204-011-450-001, -007, -105, -113, and -119;
- Increases the RIN factor assessed for each torque event for BHTI Model 204B and 205B helicopters;

- Applies a standard RIN factor for all external load lifts regardless of altitude change and type of load lifted; and
- Requires a one-time special inspection of certain S/N masts for inadequate radii and presence of burrs in the snap ring groove areas.

This AD differs from AD 2000-08-52 in that it:

- Requires that the accumulated RIN for all mast and trunnion history prior to the implementation of RIN counting (required by AD 98-24-15) be corrected for inadequate factors used to calculate factored hours TIS and to convert factored flight hours to accumulated RIN;
- Increases the RIN factor for each takeoff and external load lift for masts and trunnions installed on BHTI Model 204B, 205A, and 205A-1 helicopters to properly reflect the actual level of torque (horsepower rating) applied to the mast when it is installed in these helicopter models;
- Expands the requirement for a one-time special inspection to detect inadequate radii and burrs in the snap ring grooves to include masts with S/N's 00000 through 52720, 61433 through 61444, and 61457 through 61465, regardless of prefix;
- Establishes RIN factors for masts and trunnions which have been previously installed on military helicopters (BHTI-manufactured Model HH-1K, TH-1F, TH-1L, UH-1A, UH-1B, UH-1C, UH-1D, UH-1E, UH-1F, UH-1G, UH-1H, UH-1L, UH-1M, UH-1N, and UH-1P; and Southwest Florida Aviation SW204, SW204HP, SW205, and SW205A-1) and restricted category helicopters (Firefly Aviation Helicopter Services (previously Erickson Air Crane Co.); Garlick Helicopters, Inc.; Hawkins and Powers Aviation, Inc.; International Helicopters, Inc.; Tamarack Helicopters, Inc. (previously Ranger Helicopter Services, Inc.); Robinson Air Crane, Inc.; Williams Helicopter Corporation (previously Scott Paper Co.); Smith Helicopters; Southern Helicopter, Inc.; Southwest Florida Aviation; Utah State University; Western International Aviation, Inc.; and U.S. Helicopter, Inc.).
- Requires the immediate removal from service of any mast that has been previously installed with a hub spring.

This rule is issued under 49 U.S.C. Section 44701 pursuant to the authority delegated to me by the Administrator and is effective immediately upon receipt of this emergency AD.

2000-15-52 BELL HELICOPTER TEXTRON INC.: Docket No. 2000-SW-28-AD. Supersedes Emergency AD 2000-08-52, Docket No. 2000-SW-20-AD, and AD 98-24-15, Amendment 39-10900, Docket No. 97-SW-20-AD.

Applicability: Model 204B, 205A, 205A-1, 205B, and 212 helicopters, with main rotor mast (mast), part number (P/N) 204-011-450-001, -007, -105, -113, or -119, or main rotor trunnion (trunnion), P/N 204-011-105-001 or -103, installed, certificated in any category.

NOTE 1: This AD applies to each helicopter identified in the preceding applicability provision, regardless of whether it has been otherwise modified, altered, or repaired in the area subject to the requirements of this AD. For helicopters that have been modified, altered, or repaired so that the performance of the requirements of this AD is affected, the owner/operator must request approval for an alternative method of compliance in accordance with paragraph (i) of this AD. The request should include an assessment of the effect of the modification, alteration, or repair on the unsafe condition addressed by this AD; and if the unsafe condition has not been eliminated, the request should include specific proposed actions to address it.

Compliance: Required as indicated, unless accomplished previously.

NOTE 2: This AD has new requirements which must be complied with even if AD's 98-24-15 and 2000-08-52 have already been accomplished. This AD requires the recalculation of accumulated mast and trunnion RIN and increases the RIN factors for masts and trunnions installed on certain helicopter models. This AD also expands the S/N applicability for the one-time special inspection of the mast.

To prevent failure of a mast or trunnion, separation of the main rotor system, and subsequent loss of control of the helicopter, accomplish the following:

(a) Before further flight, determine the accumulated Retirement Index Number (RIN) in accordance with the Instructions in Appendix 1 for the mast and Appendix 2 for the trunnion. If the helicopter model installation history or hours time-in-service (TIS) of the mast or trunnion is unknown, remove the mast or trunnion from service and replace it with an airworthy mast or trunnion. If the mast has been installed on

certain military helicopters (BHTI-manufactured Model HH-1K, TH-1F, TH-1L, UH-1A, UH-1B, UH-1C, UH-1D, UH-1E, UH-1F, UH-1G, UH-1H, UH-1L, UH-1M, UH-1N, and UH-1P; and Southwest Florida Aviation SW204, SW204HP, SW205, or SW205A-1) or restricted category helicopters (Firefly Aviation Helicopter Services (previously Erickson Air Crane Co.); Garlick Helicopters, Inc.; Hawkins and Powers Aviation, Inc.; International Helicopters, Inc.; Tamarack Helicopters, Inc. (previously Ranger Helicopter Services, Inc.); Robinson Air Crane, Inc.; Williams Helicopter Corporation (previously Scott Paper Co.); Smith Helicopters; Southern Helicopter, Inc.; Southwest Florida Aviation; Utah State University; Western International Aviation, Inc.; and U.S. Helicopter, Inc.) and you cannot verify that hub springs have not been installed, remove the mast from service and replace it with an airworthy mast.

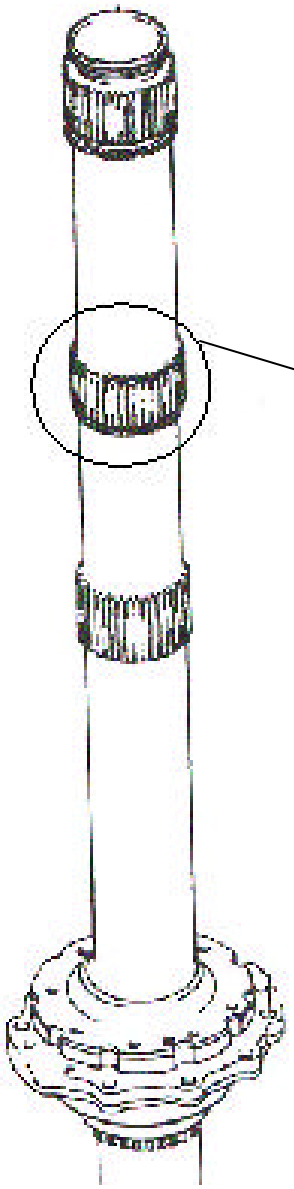
(b) Before further flight, replace any mast, P/N 204-011-450-113 or 119, that has accumulated 240,000 or more RIN with an airworthy mast. Before further flight, replace any mast, P/N 204-011-450-001, -007, or -105, that has accumulated 265,000 or more RIN with an airworthy mast.

(c) Before further flight, replace any trunnion, P/N 204-011-105-103, that has accumulated 240,000 or more RIN with an airworthy trunnion. Before further flight, replace any trunnion, P/N 204-011-105-001, that has accumulated 265,000 or more RIN with an airworthy trunnion.

(d) Before reaching 100,000 RIN, inspect the upper and lower snap ring grooves in the damper clamp splined area of any mast with serial number (S/N) 00000 through 52720, S/N 61433 through 61444, and S/N 61457 through S/N 61465 (regardless of prefix) for:

(1) A minimum radius of 0.020 inches around the entire circumference (see Figures 1 through 3), using a 100x or higher magnification. If any snap ring groove radius is less than 0.020 inches, replace the mast with an airworthy mast prior to exceeding **100,000 RIN**.

(2) A burr, using a 200x or higher magnification. If a burr is found in any snap ring groove/spline intersection, replace the mast with an airworthy mast prior to exceeding **170,000 RIN.**



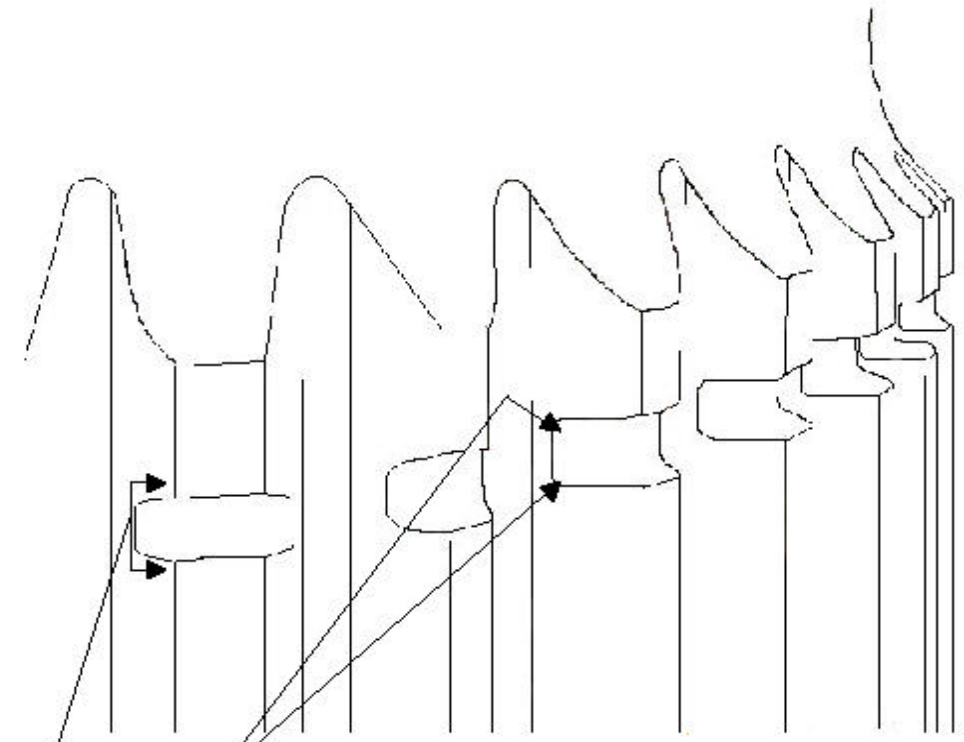
View A

Inspect area for:

- At 100x minimum magnification
  Minimum radius of 0.020 at the snap ring groove/spline intersection
- At 200x minimum magnification
  Burrs in the snap ring groove

See view A-A for detail

Figure 1

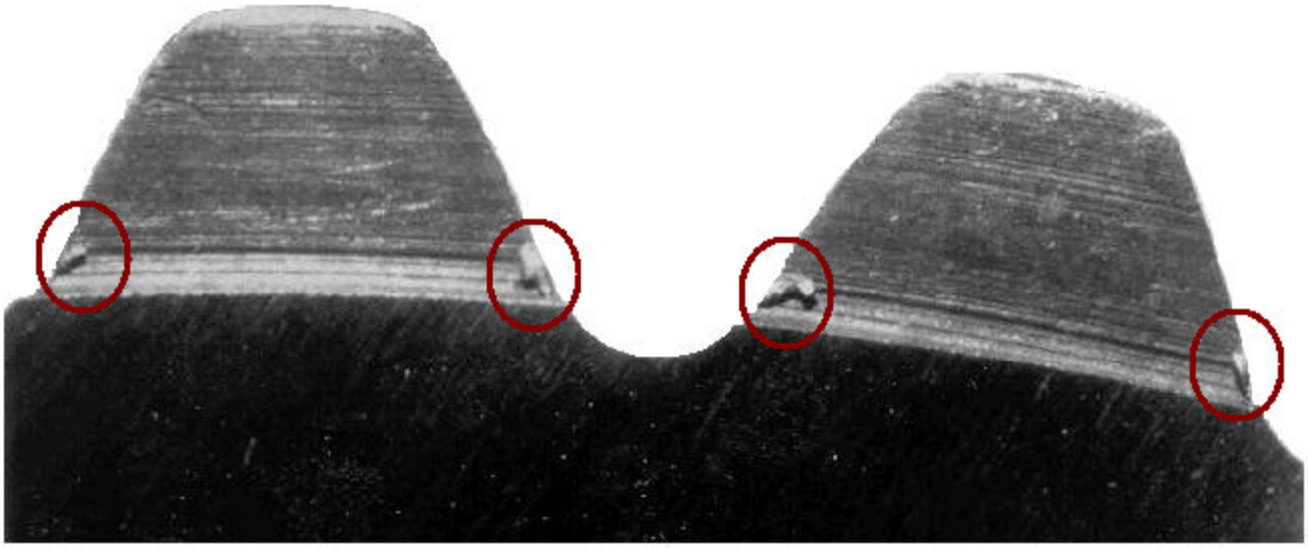


View A-A

Inspect for minimum 0.020 radius in the snap ring groove using 100x magnification minimum (upper and lower grooves, entire circumference).

Inspect for burrs at the snap ring groove/spline intersection using 200x magnification minimum (upper and lower grooves, all places).

Figure 2
Snap Ring Groove/Spline Intersection



Cutaway View Looking Down from Inside Snap Ring Groove
Typical Burrs at Snap Ring Groove/Spline Intersection
Burrs are to be Inspected at 200x Minimum Magnification

Figure 3
Typical Burr at Snap Ring Groove

(e) Continue to calculate the accumulated RIN for the mast by multiplying all takeoff and external load lifts by the RIN factors defined in columns (D) and (G) of Table 1 of Appendix 1.

(f) Continue to calculate the accumulated RIN for the trunnion by multiplying all takeoff and external load lifts by the RIN factors defined in columns (D) and (G) of Table 1 of Appendix 2.

(g) Before further flight, revise the Airworthiness Limitations section of the maintenance manuals for the masts and trunnions in accordance with Figure 4.

Mast and Trunnion Life Limits

Mast Part Number	Hours TIS Life Limit	RIN Life Limit		**Trunnion** Part Number	Hours TIS Life Limit	RIN Life Limit
204-011-450-001	6,000	265,000		204-011-105-001	15,000	265,000
204-011-450-007	15,000	265,000		204-011-105-103	13,000	240,000
204-011-450-105	15,000	265,000				
204-011-450-113	13,000	240,000				
204-011-450-119	13,000	240,000				

Figure 4

(h) Within 10 days after completing the inspections required by this AD, provide the information contained on the AD inspection report, sample format, contained in Appendix 3 and send it to the Manager, Rotorcraft Certification Office, Federal Aviation Administration, Fort Worth, Texas, 76193-0170, USA. Reporting requirements have been approved by the Office of Management and Budget and assigned OMB control number 2120-0056.

(i) An alternative method of compliance or adjustment of the compliance time that provides an acceptable level of safety may be used if approved by the Manager, Rotorcraft Certification Office, FAA. Operators shall submit their requests through an FAA Principal Maintenance Inspector, who may concur or comment and then send it to the Manager, Rotorcraft Certification Office.

NOTE 3: Information concerning the existence of approved alternative methods of compliance with this AD, if any, may be obtained from the Manager, Rotorcraft Certification Office.

(j) Special flight permits may be issued in accordance with sections 21.197 and 21.199 of the Federal Aviation Regulations (14 CFR 21.197 and 21.199) to operate the helicopter to a location where the requirements of this AD can be accomplished.

(k) Emergency AD 2000-15-52, issued July 25, 2000, becomes effective upon receipt.

FOR FURTHER INFORMATION CONTACT: Jurgen Priester, Aviation Safety Engineer, FAA, Rotorcraft Directorate, Rotorcraft Certification Office, Fort Worth, Texas 76193-0170, telephone (817) 222-5159, fax (817) 222-5783.

Issued in Fort Worth, Texas on July 25, 2000.
Mark R. Schilling, Acting Manager, Rotorcraft Directorate, Aircraft Certification Service.

Appendix 1 to AD 2000-15-52

Instructions for Calculating Mast RIN

Definition of Retirement Index Number:

The overall **fatigue life** of a main rotor mast is a function of the number of cycles of torque, lift, and bending loads applied to it during the various modes of operation. The mast experiences both high cycle fatigue and low cycle fatigue during operation.

The **high cycle fatigue life** of the mast is a function of high frequency but relatively low level cyclic loads, which are primarily induced by rotor r.p.m. The high cycle fatigue life limit for the mast is defined in terms of hours TIS because rotor r.p.m. is basically a constant value.

The **low cycle fatigue life** of the mast is a function of the number of less frequent but relatively high level cyclic loads experienced primarily during takeoffs and external load lifts. The low cycle fatigue life limit for the mast is expressed in terms of the accumulated Retirement Index Number (RIN).

The **accumulated RIN** is defined as the total number of load cycles experienced (since new) by the mast multiplied by a **RIN factor** to account for the difference in torque levels applied to the same mast when installed in different helicopter models. The level of torque applied to the mast is directly proportional to the transmission output horsepower. The manufacturer's established mast **RIN life limit** is based on the measured number of cycles to failure of masts (in laboratory tests) at various levels of constant torque, lift, and bending loads which are representative of the expected operating environment.

Calculation of Retirement Index Number:

There are two methods for calculating the accumulated RIN, depending on the available service history information for the mast. In some cases, one method will be used for a portion of the mast service history, and the other method will be used for another portion of the mast service history. Both methods require knowledge of all the helicopter models in which the mast was installed.

Calculation of RIN when Number of Takeoffs and External Load Lifts is Known (Reference Table 1):

If the total number of takeoffs and the total number of external load lifts for the mast are known, the accumulated RIN must be calculated by multiplying each takeoff and each external load lift by a RIN factor determined to be appropriate for the torque (horsepower) of the helicopter model in which the mast is installed.

Table 1 of Appendix 1 is a worksheet for calculating the accumulated mast RIN when the number of takeoffs and external load lifts is known.

The RIN factor for each external load lift is twice that specified for each takeoff. This is because two torque events are experienced during a typical external load lift.

Using Table 1, calculate accumulated RIN as follows:

1. Enter the total number of takeoffs for the particular mast model/helicopter model combination in column (C).
2. Multiply the value entered in column (C) by the RIN factor listed in column (D), and enter the result in column (E). This is the total accumulated RIN due to takeoffs.

3. Enter the total number of external load lifts for the particular mast model/helicopter model combination in column (F).
4. Multiply the value entered in column (F) by the RIN factor listed in column (G), and enter the result in column (H). This is the accumulated RIN due to external load lifts.
5. Add the values from column (E) and column (H) and enter the result in column (I). This is the total accumulated RIN to date for the mast for the particular mast model/helicopter model combination.
6. Add the accumulated RIN subtotals for the various mast model/helicopter combinations in column (I) and enter the result in the space provided. This is the total accumulated RIN for the mast.

Calculation of RIN when Exact Number of Takeoffs and External Load Lifts is Unknown (Reference Tables 2 and 3):

If either the exact total number of takeoffs or the exact total number of external load lifts for the mast model/helicopter model combination is unknown, then the accumulated RIN must be calculated by multiplying the (unfactored) hours TIS by a RIN conversion factor based on the torque (horsepower) of the helicopter model in which it was installed. The resultant factored hours TIS is then multiplied by a RIN conversion factor retained from AD 98-24-15 to establish a baseline accumulated RIN count. The FAA has determined that the factors used to establish the factored hours in earlier ASB's as well as the RIN conversion factors specified in AD 98-24-15 are inadequate. Consequently, this AD (2000-15-52) requires that the baseline accumulated RIN count be further multiplied by an additional RIN adjustment factor.

Tables 2 and 3 of Appendix 1 are worksheets for calculating the accumulated mast RIN when the exact number of takeoffs and external load lifts is unknown. Using Tables 2 and 3, calculate accumulated mast RIN as follows:

1. Enter the (unfactored) hours TIS for the particular mast model/helicopter model combination in column (C) of Table 2.
2. Using service history for the mast, select the appropriate Frequency of Event Hour Factor from column (E) of Table 2 based on the total number of takeoffs + external load lifts per hour shown in column (D) of Table 2.
3. Multiply the value for (unfactored) hours TIS entered in column (C) by the appropriate value in column (E) for Frequency of Event Hour Factor as determined in step 2 above. Enter the result in column (F) of Table 2. This is the total FACTORED hours TIS for the particular mast model/helicopter model combination.
4. Enter the value for FACTORED hours TIS from column (F) of Table 2 into column (C) of Table 3.
5. Using Table 3, multiply the value for FACTORED hours TIS in column (C) by the appropriate RIN conversion factor listed in column (D), by the appropriate RIN adjustment factor in column (E) of Table 3, and enter the result in column (F) of Table 3. This is the accumulated RIN to date for the particular mast model/helicopter model combination.
6. Add the accumulated RIN subtotals for the various mast model/helicopter model combinations in column (F) of Table 3 and enter the result in the space provided. This is the total accumulated RIN for the mast.

Sample Mast RIN Calculation

Given the following known service history for the mast:

Mast Model -007 was first installed on a BHTI Model 204B helicopter for 1000 hours TIS and experienced an unknown number of takeoffs and external load lifts. The mast was then removed and subsequently installed on a BHTI Model 205A helicopter for 1500 hours TIS. It is known that the helicopter was used primarily for passenger carrying for the first 1000 hours of operation on this model. The exact number of takeoffs and external load lifts is unknown, but it is known that the helicopter averaged less than 20 takeoffs per hour, with no external load lifts. It was subsequently used for heavy lift operation for the remaining 500 hours of operation on this model, averaging between 20 and 44 external load lifts during this period of time. The mast was then removed and installed on a BHTI Model 212 helicopter for a total of 1500 hours TIS with accurate records indicating that it experienced 1000 takeoffs and 2000 external load lifts.

Calculate the total accumulated RIN to date since new for the mast as follows:

Accumulated RIN while installed in BHTI Model 204B:

Calculate factored flight hours from Table 2 as follows:

Factored Flight Hours = (unfactored flight hours) x (frequency of event hour factor)
= (column C) x (column E)
= (1000) x (3)
= 3000

Then using Table 3, calculate the accumulated RIN as follows:

= (factored hours TIS) x (RIN conversion factor) x (RIN adjustment factor)
= (column C) x (column D) x (column E)
= (3000) x (20) x (1)

= 60,000 RIN

Accumulated RIN while installed in BHTI Model 205A:

Calculate factored flight hours from Table 2 as follows:

Factored Flight Hours = (unfactored flight hours) x (frequency of event hour factor)
(for first 1000 hrs.) = (column C) x (column E)
= (1000) x (1)
= 1000

Factored Flight Hours = (unfactored flight hours) x (frequency of event hour factor)
(for next 500 hrs) = (column C) x (column E)
= (500) x (2)
= 1000

Then using Table 3, calculate the accumulated RIN as follows:

= (factored hours TIS) x (RIN conversion factor) x (RIN adjustment factor)
= (column C) x (column D) x (column E)
= (1000) x (20) x (10) + (1000) x (20) x (10)
= 200,000 + 200,000
= 200,000 + 200,000
= 400,000 RIN

Accumulated RIN while installed in BHTI Model 212:

Calculate the accumulated RIN from Table 1 and the given number of takeoff and lifts as follows:

Accumulated RIN = (number of takeoffs x RIN factor per takeoff) + (number of lifts x RIN Factor per lift)

= (column C) x (Column D) + (Column F) x (Column G)
= (1,000) x (5) + (2,000) x (10)
= 25,000 RIN

Therefore, the total accumulated RIN to date for the mast is the sum of the subtotals from Tables 1 and 3 for the period of time the mast was installed on the BHTI Model 204B, 205A, and 212 helicopters:

Total accumulated mast RIN = 60,000 + 400,000 + 25,000
= **485,000**

Please note that the recalculated total accumulated RIN for this sample mast would have exceeded the 265,000 allowable RIN life. This mast would therefore be removed from service.

The values for the sample problem are shown in bold italics in Tables 1 - 3 for illustration purposes.

Mast RIN Calculation Based on Takeoffs and External Load Lifts

Mast A/C Model Installation	Mast P/N 204-011-450	Number Of Takeoffs	RIN Factor Per Takeoff	Total Takeoff RIN	Number of External Load Lifts	RIN Factor Per External Load Lift	Total Lift RIN	Accumulated RIN
(A)	(B)	(C)	(D)	(E) =(C) x (D)	(F)	(G)	(H) =(F) x (G)	(I) =(E) + (H)
204B (≤1100 T.O. hp SLS)	204-011-450-001		10			20		
204B (≤1100 T.O. hp SLS)	204-011-450-007		2			4		
204B (≤1100 T.O. hp SLS)	204-011-450-105		2			4		
204B (>1100 T.O. hp SLS)	All		Contact FAA*			Contact FAA*		Contact FAA*
205A/A-1 (≤1250 T.O. hp SLS)	204-011-450-007		5			10		
205A/A-1 (≤1250 T.O. hp SLS)	204-011-450-105		5			10		
205A/A-1 (>1250 T.O. hp SLS)	All		Contact FAA*			Contact FAA*		Contact FAA*
205B (≤1290 T.O. hp SLS)	204-011-450-007		6			12		
205B (≤1290 T.O. hp SLS)	204-011-450-105		6			12		
205B (>1290 T.O. hp SLS)	All		Contact FAA*			Contact FAA*		Contact FAA*
212 (≤1290 T.O. hp SLS)	204-011-450-007	***1000***	5	***5000***	***2000***	10	***20,000***	***25,000***
212 (≤1290 T.O. hp SLS)	204-011-450-105		5			10		
212 (>1290 T.O. hp SLS)	-007 or –105		Contact FAA*			Contact FAA*		Contact FAA*
212 (≤1350 T.O. hp SLS)	204-011-450-113		6			12		
212 (≤1350 T.O. hp SLS)	204-011-450-119		6			12		
Restricted Category or Military TIS with (≤700 T.O. hp SLS)	204-011-450-001		1.25			2.5		
	204-011-450-007		0.25			0.5		
	204-011-450-105		0.25			0.5		
Restricted Category or Military TIS with (≤1000 T.O. hp SLS)	204-011-450-001		7.5			15		
	204-011-450-007		1.5			3		
	204-011-450-105		1.5			3		
Restricted Category or Military TIS with (≤1100 T.O. hp SLS)	204-011-450-001		15			30		
	204-011-450-007		3			6		
	204-011-450-105		3			6		
Restricted Category or Military TIS with (≤1290 T.O. hp SLS)	204-011-450-001		Not Approved			Not Approved		Not Approved
	204-011-450-007		6			12		
	204-011-450-105		6			12		
Restricted Category or Military TIS with (>1290 T.O. hp SLS)	204-011-450-001		Contact FAA*			Contact FAA*		Contact FAA*
	204-011-450-007							
	204-011-450-105							
Total RIN=								***25,000***

*Contact FAA at (817) 222-5159 Appendix 1 - Table 1

Calculation of Mast Factored Hours Time-in-Service

Mast A/C Model Installation	Mast P/N 204-011-450	Unfactored Hours TIS on Model	Frequency Of Events Per Hour	Frequency of Event Hour Factor	FACTORED Hours TIS On Model
(A)	(B)	(C)	(D)	(E)	(F) = (C) x (E)
204B	204-011-450-001, -007,		1.0-20.00	1.00	
	or -105		20.01-44.00	2.00	
			44.01-69.00	3.00	
			Greater than 69.00	Contact FAA*	
		1,000	Unknown	3.00	***3,000***
205A/A-1	204-011-450-007,-105,	***1,000***	1.0-20.00	1.00	***1,000***
	-113, or -119	***500***	20.01-44.00	2.00	***1,000***
			44.01-69.00	3.00	
			Greater than 69.00	Contact FAA*	
			Unknown	3.00	
205B	204-011-450-007,-105		1.0-5.00	1.00	
			5.01-8.00	1.50	
			8.01-12.00	2.00	
			12.01-18.00	3.00	
			18.01-32.00	5.00	
			32.01-48.00	7.00	
			48.01-62.00	9.00	
			Greater than 62.00	Contact FAA*	
			Unknown	9.00	
212	204-011-450-007,-105,		1.0-5.00	1.00	
	-113, or -119		5.01-8.00	1.50	
			8.01-12.00	2.00	
			12.01-18.00	3.00	
			18.01-32.00	5.00	
			32.01-48.00	7.00	
			48.01-62.00	9.00	
			Greater than 62.00	Contact FAA*	
			Unknown	9.00	

*Contact FAA at (817) 222-5159 Appendix 1 - Table 2 (1st page of 2)

Calculation of Mast Factored Hours Time-in-Service

Mast A/C Model Installation	Mast P/N 204-011-450 (without a hub spring)	Unfactored Hours TIS on Model	Frequency Of Events Per Hour	Frequency of Event Hour Factor	FACTORED Hours TIS On Model
(A)	(B)	(C)	(D)	(E)	(F) = (C) x (E)
Restricted Category TIS (≤700 hp)	204-011-450-007		1.0-37.00	1.00	
	or –105		37.01-46.00	1.25	
			46.01-55.00	1.50	
			55.01-63.00	1.75	
			Greater than 63.00	Contact FAA*	
			Unknown	1.75	
Restricted Category TIS (≤1000 hp)	204-011-450-007		1.0-7.00	1.00	
	or -105		7.01-13.00	2.00	
			13.01-18.00	3.00	
			18.01-30.00	5.00	
			30.01-41.0	7.00	
			41.01-52.00	9.00	
			52.01-63.00	11.00	
			Greater than 63.00	Contact FAA*	
			Unknown	11.00	
Restricted Category TIS (≤1100 hp)	204-011-450-007		1.0-5.00	1.00	
	or -105		5.01-7.00	2.00	
			7.01-10.00	3.00	
			10.01-16.00	5.00	
			16.01-24.0	7.50	
			24.01-31.00	10.00	
			31.01-46.00	15.00	
			46.01-61.00	20.00	
			Greater than 61.00	Contact FAA*	
			Unknown	20.00	
Restricted Category TIS (≤1290 hp)	204-011-450-007		1.0-5.00	2.10	
	or -105		5.01-7.00	4.00	
			7.01-10.00	6.00	
			10.01-15.00	9.00	
			15.01-19.00	12.00	
			19.01-25.00	16.00	
			25.01-31.00	20.00	
			31.01-46.00	30.00	
			46.01-60.00	40.00	
			Greater than 60.00	Contact FAA*	
			Unknown	40.00	
Military TIS	204-011-450-001,				
(≤700 hp SLS)	-007, or -105		All	1.00	
(≤1000 hp SLS)			All	3.00	
(≤1100 hp SLS)			All	6.00	
(≤1290 hp SLS)			All	12.00	

*Contact FAA at (817) 222-5159 Appendix 1 - Table 2 (continued - 2nd page of 2)

Mast RIN Calculation Based on Hours Time-in-Service

Mast A/C Model Installation	Mast P/N 204-011-450	FACTORED Hours TIS On Model	RIN FACTOR Per AD 98-24-15	RIN Adjustment Per AD 2000-15-52	Accumulated RIN
(A)	(B)	(C) (From Table 2 of Appendix I)	(D)	(E)	(F) =(C) x (D) x (E)
204B (≤1100 T.O. hp SLS)	204-011-450-001		50	1	
204B (≤1100 T.O. hp SLS)	204-011-450-007	***3000***	20	1	***60,000***
204B (≤1100 T.O. hp SLS)	204-011-450-105		20	1	
204B (>1100 T.O. hp SLS)	All	Contact FAA*	Contact FAA*	Contact FAA*	Contact FAA*
205A/A-1 (≤1250 T.O. hp SLS)	204-011-450-007	***2000***	20	10	***400,000***
205A/A-1 (≤1250 T.O. hp SLS)	204-011-450-105		20	10	
205A/A-1 (>1250 T.O. hp SLS)	All	Contact FAA*	Contact FAA*	Contact FAA*	Contact FAA*
205B (≤1290 T.O. hp SLS)	204-011-450-007		20	1	
205B (≤1290 T.O. hp SLS)	204-011-450-105		20	1	
205B (>1290 T.O. hp SLS)	All	Contact FAA*	Contact FAA*	Contact FAA*	Contact FAA*
212 (≤1290 T.O. hp SLS)	204-011-450-007		20	1	
212 (≤1290 T.O. hp SLS)	204-011-450-105		20	1	
212 (>1290 T.O. hp SLS)	-007 or –105		Contact FAA*	Contact FAA*	Contact FAA*
212 (≤1350 T.O. hp SLS)	204-011-450-113		21.2	1.2	
212 (≤1350 T.O. hp SLS)	204-011-450-119		21.2	1.2	
212 (>1350 T.O. hp SLS)	-113 or –119	Contact FAA*	Contact FAA*	Contact FAA*	Contact FAA*
Restricted Category	204-011-450-001		50	1	
or Military TIS with	204-011-450-007		20	1	
(≤1290 T.O. hp SLS)	204-011-450-105		20	1	
Restricted Category	204-011-450-001				
or Military TIS with	204-011-450-007	Contact FAA*	Contact FAA*	Contact FAA*	Contact FAA*
(>1290 T.O. hp SLS)	204-011-450-105				
Total RIN=					***460,000***

Appendix 2 to AD 2000-15-52

Instructions for Calculation of Trunnion RIN

Definition of Retirement Index Number:

The overall **fatigue life** of a main rotor trunnion is a function of the number of cycles of torque, lift, and bending loads applied to it during the various modes of operation. The trunnion experiences both high cycle fatigue and low cycle fatigue during operation.

The **high cycle fatigue life** of the trunnion is a function of high frequency but relatively low level cyclic loads, which are primarily induced by rotor r.p.m. The high cycle fatigue life limit for the trunnion is defined in terms of hours TIS because rotor r.p.m. is basically a constant value.

The **low cycle fatigue life** of the trunnion is a function of the number of less frequent but relatively high level cyclic loads experienced primarily during takeoffs and external load lift operations. The low cycle fatigue life limit for the trunnion is expressed in terms of the accumulated Retirement Index Number (RIN).

The **accumulated RIN** is defined as the total number of load cycles experienced (since new) by the trunnion multiplied by a **RIN factor** to account for the difference in torque levels applied to the same trunnion when installed in different helicopter models. The level of torque applied to the trunnion is directly proportional to the transmission output horsepower. The manufacturer's established trunnion **RIN life limit** is based on the measured number of cycles to failure of trunnions (in laboratory tests) at various levels of constant torque, lift, and bending loads, which are representative of the expected operating environment.

Calculation of Retirement Index Number:

There are two methods for calculating the accumulated RIN, depending on the available service history information for the trunnion. In some cases, one method will be used for a portion of the trunnion service history, and the other method will be used for another portion of the trunnion service history. Both methods require knowledge of all the helicopter models in which the trunnion was installed.

Calculation of RIN when Number of Takeoffs and External Load Lifts is Known Reference Table 1):

If the total number of takeoffs and the total number of external load lifts for the trunnion are known, the accumulated RIN must be calculated by multiplying each takeoff and each external load lift by a RIN factor determined to be appropriate for the torque (horsepower) of the helicopter model in which the trunnion is installed.

Table 1 of Appendix 2 is a worksheet for calculating the accumulated trunnion RIN when the number of takeoffs and external load lifts is known.

The RIN factor for each external load lift is twice that specified for each takeoff. This is because two torque events are experienced during a typical external load lift.

Using Table 1, calculate accumulated RIN as follows:

1. Enter the total number of takeoffs for the particular trunnion model/helicopter model combination in column (C).
2. Multiply the value entered in column (C) by the RIN factor listed in column (D), and enter the result in column (E). This is the total accumulated RIN due to takeoffs.
3. Enter the total number of external load lifts for the particular trunnion model/helicopter model combination in column (F).

4. Multiply the value entered in column (F) by the RIN factor listed in column (G), and enter the result in column (H). This is the accumulated RIN due to external load lifts.
5. Add the values from column (E) and column (H) and enter the result in column (I). This is the total accumulated RIN to date for the trunnion for the particular trunnion model/helicopter model combination.
6. Add the accumulated RIN subtotals for the various trunnion model/helicopter combinations in column (I) and enter the result in the space provided. This is the total accumulated RIN for the trunnion.

Calculation of RIN when Exact Number of Takeoffs and External Load Lifts is Unknown (Reference Tables 2 and 3):

If either the exact total number of takeoffs or the exact total number of external load lifts for the trunnion model/helicopter model combination is unknown, then the accumulated RIN must be calculated by multiplying the (unfactored) hours TIS by a RIN conversion factor based on the torque (horsepower) of the helicopter model in which it was installed. The resultant factored hours TIS is then multiplied by a RIN conversion factor retained from AD 98-24-15 to establish a baseline accumulated RIN count. The FAA has determined that the factors used to establish the factored hours in earlier ASB's as well as the RIN conversion factors specified in AD 98-24-15 are inadequate. Consequently, this AD (2000-15-52) requires that the baseline accumulated RIN count be further multiplied by an additional RIN adjustment factor.

Tables 2 and 3 of Appendix 2 are worksheets for calculating the accumulated trunnion RIN when the exact number of takeoffs and external load lifts is unknown. Using Tables 2 and 3, calculate accumulated trunnion RIN as follows:

1. Enter the (unfactored) hours TIS for the particular trunnion model/helicopter model combination in column (C) of Table 2.
2. Using service history for the trunnion, select the appropriate Frequency of Event Hour Factor from column (E) of Table 2 based on the total number of takeoffs + external load lifts per hour shown in column (D) of Table 2.
3. Multiply the value for (unfactored) hours TIS entered in column (C) by the appropriate value in column (E) for Frequency of Event Hour Factor as determined in step 2 above. Enter the result in column (F) of Table 2. This is the total FACTORED hours TIS for the particular trunnion model/helicopter model combination.
4. Enter the value for FACTORED hours TIS from column (F) of Table 2 into column (C) of Table 3.
5. Using Table 3, multiply the value for FACTORED hours TIS in column (C) by the appropriate RIN conversion factor listed in column (D), by the appropriate RIN adjustment factor in column (E) of Table 3, and enter the result in column (F) of Table 3. This is the accumulated RIN to date for the particular trunnion model / helicopter model combination.
6. Add the accumulated RIN subtotals for the various trunnion model / helicopter model combinations in column (F) of Table 3 and enter the result in the space provided. This is the total accumulated RIN for the trunnion.

Sample Trunnion RIN Calculation

Given the following known service history for the trunnion:

Trunnion Model -001 was first installed on a BHTI Model 204B helicopter for 1000 hours TIS, and experienced an unknown number of takeoffs and external load lifts. The trunnion was then removed and subsequently installed on a BHTI Model 205A helicopter for 1500 hours TIS. It is known that the helicopter was used primarily for passenger carrying for the first 1000 hours of operation on this model. The exact number of takeoffs and external load lifts is unknown, but it is known that the helicopter averaged less than 20 takeoffs per hour, with no external load lifts. It was subsequently used for heavy lift operation for the remaining 500 hours of operation on this model, averaging between 20 and 44 external load lifts during this period of time. The trunnion was then removed and installed on a model 212 helicopter for a total of 1500 hours TIS with accurate records indicating that it experienced 1000 takeoffs and 2000 external load lifts.

Calculate the total accumulated RIN to date since new for the trunnion as follows:

Accumulated RIN while installed in BHTI Model 204B:

Calculate factored flight hours from Table 2 as follows:

Factored Flight Hours = (unfactored flight hours) x (frequency of event hour factor)
= (column C) x (column E)
= (1000) x (3)
= 3000

Then using Table 3, calculate the accumulated RIN as follows:

= (factored hours TIS) x (RIN conversion factor) x (RIN adjustment factor)
= (column C) x (column D) x (column E)
= (3000) x (20) x (1)

= 60,000 RIN

Accumulated RIN while installed in BHTI Model 205A:

Calculate factored flight hours from Table 2 as follows:

Factored Flight Hours = (unfactored flight hours) x (frequency of event hour factor)
(for first 1000 hrs) = (column C) x (column E)
= (1000) x (1)
= 1000

Factored Flight Hours = (unfactored flight hours) x (frequency of event hour factor)
(for next 500 hrs) = (column C) x (column E)
= (500) x (2)
= 1000

Then using Table 3, calculate the accumulated RIN as follows:

= (factored hours TIS) x (RIN conversion factor) x (RIN adjustment factor)
= (column C) x (column D) x (column E)
= (1000) x (20) x (10) + (1000) x (20) x (10)
= 200,000 + 200,000
= 200,000 + 200,000
= 400,000 RIN

Accumulated RIN while installed in BHTI Model 212:

Calculate the accumulated RIN from Table 1 and the given number of takeoff and lifts as follows:

Accumulated RIN = (number of takeoffs x RIN factor per takeoff) + (number of lifts x RIN Factor per lift)

= (column C) x (Column D) + (Column F) x (Column G)

= (1,000) x (5) + (2,000) x (10)

= 25,000 RIN

Therefore, the total accumulated RIN to date for the trunnion is the sum of the subtotals for the period of time the trunnion was installed on the BHTI Model 204B, 205A, and 212 helicopters:

Total accumulated trunnion RIN = 60,000 + 400,000 + 25,000
= **485,000**

Please note that the recalculated total accumulated RIN for this sample trunnion would have exceeded the 265,000 allowable RIN life. This trunnion would therefore be removed from service.

The values for the sample problem are shown in bold italics in Tables 1-3 for illustration purposes.

Trunnion RIN Calculation Based on Takeoffs and External Load Lifts

Trunnion A/C Model Installation	Trunnion P/N	Number Of Takeoffs	RIN Factor Per Takeoff	Total Takeoff RIN	Number Of External Load Lifts	RIN Factor Per External Load Lift	Total Lift RIN	Accumulated RIN
(A)	(B)	(C)	(D)	(E) = (C) x (D)	(F)	(G)	(H) = (F) x (G)	(I) = (E) + (H)
204B (≤1100 T.O. hp SLS)	204-011-105-001		2			4		
204B (>1100 T.O. hp SLS)	204-011-105-001		Contact FAA*			Contact FAA*		Contact FAA*
205A/A-1 (≤1250 T.O. hp SLS)	204-011-105-001		5			10		
205A/A-1 (>1250 T.O. hp SLS)	204-011-105-001		Contact FAA*			Contact FAA*		Contact FAA*
205B (≤1290 T.O. hp SLS)	204-011-105-001		6			12		
205B (>1290 T.O. hp SLS)	204-011-105-001		Contact FAA*			Contact FAA*		Contact FAA*
212 (≤1290 T.O. hp SLS)	204-011-105-001	***1000***	5	5000	***2000***	10	***20,000***	***25,000***
212 (>1290 T.O. hp SLS)	204-011-105-001		Contact FAA*			Contact FAA*		Contact FAA*
212 (≤1350 T.O. hp SLS)	204-011-105-103		6			12		
212 (>1350 T.O. hp SLS)	204-011-105-103		Contact FAA*			Contact FAA*		Contact FAA*
Restricted Category Or Military TIS with:	204-011-105-001							
(≤700 T.O. hp SLS)			0.25			0.5		
(≤1000 T.O. hp SLS)			1.5			3		
(≤1100 T.O. hp SLS)			3			6		
(≤1290 T.O. hp SLS)			6			12		
(>1290 T.O. hp SLS)			Contact FAA*			Contact FAA*		Contact FAA*
Total RIN=								***25,000***

*Contact FAA at (817) 222-5159 Appendix 2 - Table 1

Calculation of Trunnion Factored Hours Time-in-Service

Trunnion A/C Model Installation	Trunnion P/N	Unfactored Hours TIS on Model	Frequency Of Events Per Hour	Frequency of Event Hour Factor	FACTORED Hours TIS On Model
(A)	(B)	(C)	(D)	(E)	(F) = (C) x (E)
204B	204-011-105-001		1.0-20.00	1.00	
			20.01-44.00	2.00	
			44.01-69.00	3.00	
			Greater than 69.00	Contact FAA	
		1000	Unknown	3.00	***3000***
205A/A-1	204-011-105-001	***1000***	1.0-20.00	1.00	***1000***
		500	20.01-44.00	2.00	***1000***
			44.01-69.00	3.00	
			Greater than 69.00	Contact FAA	
			Unknown	3.00	
205B	204-011-105-001		1.0-5.00	1.00	
			5.01-8.00	1.50	
			8.01-12.00	2.00	
			12.01-18.00	3.00	
			18.01-32.00	5.00	
			32.01-48.00	7.00	
			48.01-62.00	9.00	
			Greater than 62.00	Contact FAA	
			Unknown	9.00	
212	204-011-105-001		1.0-5.00	1.00	
	or, -103		5.01-8.00	1.50	
			8.01-12.00	2.00	
			12.01-18.00	3.00	
			18.01-32.00	5.00	
			32.01-48.00	7.00	
			48.01-62.00 Greater than 62.00	9.00 Contact FAA	
			Unknown	9.00	

*Contact FAA at (817) 222-5159

Calculation of Trunnion Factored Hours Time-in-Service

Trunnion A/C Model Installation	Trunnion P/N 204-011-105-001 (without a hub spring)	Unfactored Hours TIS on Model	Frequency of Events Per Hour	Frequency of Event Hour Factor	FACTORED Hours TIS On Model
(A)	(B)	(C)	(D)	(E)	(F) = (C) x (E)
Restricted Category TIS (≤700 hp)	204-011-105-001		1.0-37.00	1.00	
			37.01-46.00	1.25	
			46.01-55.00	1.50	
			55.01-63.00	1.75	
			Greater than 63.00	Contact FAA*	
			Unknown	1.75	
Restricted Category TIS (≤1000 hp)	204-011-105-001		1.0-7.00	1.00	
			7.01-13.00	2.00	
			13.01-18.00	3.00	
			18.01-30.00	5.00	
			30.01-41.0	7.00	
			41.01-52.00	9.00	
			52.01-64.00	11.00	
			Greater than 64.00	Contact FAA*	
			Unknown	11.00	
Restricted Category TIS (≤1100 hp)	204-011-105-001		1.0-5.00	1.00	
			5.01-8.00	2.00	
			8.01-10.00	3.00	
			10.01-16.00	5.00	
			16.01-24.0	7.50	
			24.01-31.00	10.00	
			31.01-46.00	15.00	
			46.01-61.00	20.00	
			Greater than 61.00	Contact FAA*	
			Unknown	20.00	
Restricted Category TIS (≤1290 hp)	204-011-105-001		1.0-5.00	2.10	
			5.01-7.00	4.00	
			7.01-10.00	6.00	
			10.01-15.00	9.00	
			15.01-19.00	12.00	
			19.01-25.00	16.00	
			25.01-31.00	20.00	
			31.01-46.00	30.00	
			46.01-60.00	40.00	
			Greater than 60.00	Contact FAA*	
			Unknown	40.00	
Military TIS with:	204-011-105-001				
(≤700 hp SLS)			All	1.00	
(≤1000 hp SLS)			All	3.00	
(≤1100 hp SLS)			All	6.00	
(≤1290 hp SLS)			All	12.00	

*Contact FAA at (817) 222-5159 Appendix 2-Table 2 (continued – 2nd page of 2)

Trunnion RIN Calculation Based on Hours Time-in-Service

Trunnion A/C Model Installation	Trunnion P/N	FACTORED Hours TIS On Model	RIN Factor Per AD 98-24-15	RIN Adjustment Per AD 2000-15-52	Accumulated RIN
(A)	(B)	(C) (From Table 2 of Appendix 2)	(D)	(E)	(F) = (C) x (D) x (E)
204B (≤1100 T.O. hp SLS)	204-011-105-001	***3000***	20	1	***60,000***
204B (>1100 T.O. hp SLS)	204-011-105-001		Contact FAA*	Contact FAA*	Contact FAA*
205A/A-1 (≤1250 T.O. hp SLS)	204-011-105-001	***2000***	20	10	***400,000***
205A/A-1 (>1250 T.O. hp SLS)	204-011-105-001		Contact FAA*	Contact FAA*	Contact FAA*
205B (≤1290 T.O. hp SLS)	204-011-105-001		20	1	
205B (>1290 T.O. hp SLS)	204-011-105-001		Contact FAA*	Contact FAA*	Contact FAA*
212 (≤1290 T.O. hp SLS)	204-011-105-001		20	1	
212 (>1290 T.O. hp SLS)	204-011-105-001		Contact FAA*	Contact FAA*	Contact FAA*
212 (≤1350 T.O. hp SLS)	204-011-105-103		21.2	1.2	
212 (>1350 T.O. hp SLS)	204-011-105-103		Contact FAA*	Contact FAA*	Contact FAA*
Restricted Category or Military TIS with (≤1290 T.O. hp SLS)	204-011-105-001		20	1	
Restricted Category or Military TIS with (>1290 T.O. hp SLS)	204-011-105-001		Contact FAA*	Contact FAA*	Contact FAA*
Total RIN=					***460,000***

*Contact FAA at (817) 222-5159 Appendix 2 - Table 3

APPENDIX 3 to AD 2000-15-52

AD COMPLIANCE INSPECTION REPORT
P/N 204-011-450-001/-007/-105/-113/-119 MAIN ROTOR MAST

Provide the following information and mail or fax it to:

Manager, Rotorcraft Certification Office
Federal Aviation Administration
Fort Worth, Texas, 76193-0170, USA
Fax: (817) 222-5783

Operator Name:

Aircraft Registration No:

Helicopter Model:

Helicopter S/N:

Mast P/N:

Mast S/N:

Mast RIN:

Mast Total TIS:

INSPECTION RESULTS

Were any radii during inspection of this mast determined to be less than 0.020 inches? If yes, what was the dimension measured?

Was a burr found in the inspected snap ring grooves?

Were cracks noted during the inspection?

Who performed this inspection?

Provide any other comments?